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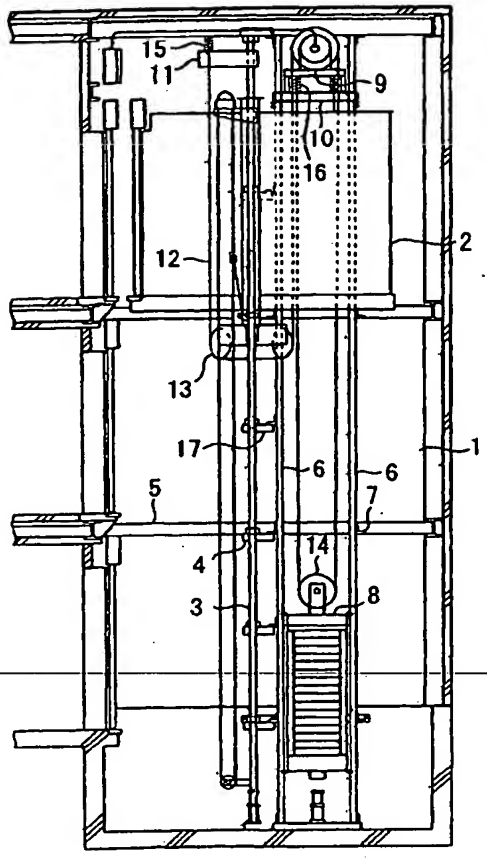
(54) ELEVATOR

(57) A support member (10) for supporting a hoisting machine (9) disposed at a position close to the top within a hoistway (1) is supported at an upper end section of counterweight rails (6) which stand upright within the hoistway (1) and guide ascending and descending operation of a counterweight (8). In connection with such a construction, a coupling member (17) is provided between rail brackets (4)-which are spaced apart from each other in the vertical direction and fasten car rails (3) to fixing members (5) of the hoistway (1)-thereby coupling the counterweight rail (6) to the car rail (3).

As a result, the displacement developing in the counterweight rail (6) in the direction orthogonal to the axis is transmitted to and supported by the car rail (3) by means of the coupling member (17). Consequently, occurrence of buckling in the counterweight rail (6) is prevented, thereby making the strength of the counterweight rail (6) close to that required to carry out a function of guiding the counterweight (8). The counterweight rail (6) can be reduced in size to a rail of standard size, thereby curtailing costs for constructing the elevator system.

FIG. 1



EP 1 447 370 A1

Description

Field of the Invention

[0001] The invention relates to an elevator system, wherein a member for supporting a hoisting machine disposed at a position close to the top within a hoistway is supported on an upper end section of counterweight rails which stand upright within the hoistway and guide ascending and descending operation of a counterweight.

Background Art

[0002] Figs. 4 and 5 are views showing a conventional elevator system that is structurally analogous to an elevator system described in, e.g., JP-A-2000-318946. Fig. 4 is a longitudinal-cross-sectional view, and Fig. 5 is a transverse cross-sectional view of the principal section of the elevator system shown in Fig. 4. Reference numeral 1 designates a hoistway for an elevator; 2 designates a car which ascends or descends within the hoistway 1; and 3 designates car rails which stand upright within the hoistway 1, which are disposed on both sides of the car 2 when viewed in horizontally-projected perspective, and which guide ascending and descending operation of the car 2.

[0003] Reference numeral 4 designates rail brackets. One side of each rail bracket 4 is secured on a corresponding fixing member 5 formed from a beam constituting a side surface of the hoistway 1, and the other side of the rail bracket 4 is fastened to the corresponding car rail 3. The rail brackets 4 are vertically spaced apart from each other within the hoistway 1.

[0004] Reference numeral 6 designates counterweight rails which stand upright within the hoistway 1 and are spaced apart from each other in a horizontal direction in the form of two lines. Of the two lines, one line is fastened to the rail brackets 4, and the other line is secured on the fixing members 5 and fastened to counterweight brackets 7 which are vertically spaced apart from each other within the hoistway 1. The counterweight rails 6 guide ascending and descending operation of a counterweight 8, which is interposed between the two lines and moves vertically within the hoistway 1.

[0005] Reference numeral 9 designates a hoisting machine disposed at a position close to the top within the hoistway 1; 10 designates a support member whose both ends are joined to an upper end section of the counterweight rails 6 and which supports the hoisting machine 9; and 11 designates a rope anchor arm projectingly provided at a position close to the upper end of the car rails 3.

[0006] Reference numeral 12 designates a main rope. One end of the main rope 12 is joined to the rope anchor arm 11. The other end of the main rope 12 is passed around a car pulley 13 rotatably mounted on a lower section of the car 2. That end of the main rope 12 is then extended upward and passed around a drive sheave of the hoisting machine 9. That end is then extended downward and passed around a suspension pulley 14 of the counterweight 8 and joined to the support member 10.

[0007] The related-art elevator system is constructed in the previously-described manner. When the hoisting machine 9 is operated, the car 2 and the counterweight 8 ascend and descend in opposite directions via the main rope 12. Self weight of the hoisting machine 9 and load stemming from tension of the main rope 12 are supported by the car rails 3 by way of the rope anchor arm 11 and by the counterweight rails 6 by way of the support member 10.

[0008] By means of such a construction, the majority of the downward load stemming from the tension of the main rope 12 and the like acts on the counterweight rails 6 as axial compressive force. For this reason, the counterweight rails 6 require strength against the axial compressive force, as well as flexural strength which acts in a direction substantially perpendicular to the axis and is required to carry out a function of guiding the counterweight 8. The counterweight rails 6, which are larger in size than those employed in a case where axial compressive force does not act on the counterweight rails, stand upright. For this reason, costs for constructing the elevator system are increased.

[0009] By means of the construction of the elevator system shown in Figs. 4 and 5, the load-which is vertically exerted on the hoistway 1; that is, a building where the elevator system is to be installed, by the elevator system-is reduced, thereby curtailing construction costs. In the case of a structure provided with wall material into which anchor bolts cannot be fastened upright; namely, a flexible structure, the rail brackets 4 and the counterweight brackets 7 are fastened to a framework material constituting floors of a building.

[0010] Therefore, the rail brackets 4 and the other members are spaced at an interval equivalent to the height of each floor of the building. Normally, the car rails 3 and the others are supported at intervals of three to four meters. In a situation where vertical load acts on the counterweight rails 6, if a support interval becomes excessively long, buckling will arise. In order to prevent occurrence of buckling, the size of the counterweight rails 6 must be increased in accordance with the support interval.

[0011] Therefore, the invention is aimed at providing an elevator system which prevents occurrence of buckling, which would otherwise be caused when a support interval becomes excessively long, by use of counterweight rails of standard size in connection with a structure of compressive load acting on the counterweight rails for guiding ascending and descending operation of a counterweight.

Summary of the Invention

[0012] According to the invention, car rails for guiding ascending and descending operation of a car stand upright within a hoistway. Counterweight ralls for guiding ascending and descending operation of a counterweight stand upright within the hoistway. A support member of a hoisting machine disposed at a position close to the top within the hoistway is supported on an upper end section of the counterweight rails. The counterweight rails are fastened to rail brackets supporting the car rails. A coupling member is interposed between the rail brackets which support the car rail and are spaced apart from each other in the vertical direction. The car rail is fastened to one side of the coupling member, and the opposing counterweight rail is fastened to the other side of the same.

[0013] As a result, the displacement developing from downward load due to tension of a main rope of the elevator in the counterweight rail in the direction orthogonal to the axis is transmitted to and supported by the car rail by way of the coupling member. Consequently, there can be obtained a counterweight rail which does not need an excessive increase in size and prevents occurrence of buckling, thereby curtailing costs for constructing the elevator system.

Brief Description of the Drawings

[0014]

Figs. 1 through 3 are views showing an example mode in which a preferable elevator system of the invention is implemented, wherein Fig. 1 is a longitudinal cross-sectional view, Fig. 2 is an enlarged perspective view showing joints shown in Fig. 1, and Fig. 3 is a plan view showing the joints shown in Fig. 2 in an enlarged manner; and

Figs. 4 and 5 are views showing a conventional elevator system, wherein Fig. 4 is a longitudinal cross-sectional view, and Fig. 5 is a transverse cross-sectional view of the principal section shown in Fig. 4.

Best Modes for Implementing the Invention

[0015] In order to provide more detailed description, the invention will be described by reference to the accompanying drawings. As shown in Figs. 1 through 3, reference numeral 1 designates a hoistway for an elevator; 2 designates a car which ascends or descends within the hoistway 1; and 3 designates car rails which stand upright within the hoistway 1, which are disposed on both sides of the car 2 when viewed in horizontally-projected perspective, and which guide ascending and descending operation of the car 2.

[0016] Reference numeral 4 designates rail brackets. One side of each rail bracket 4 is secured on a corresponding fixing member 5 formed from a beam constituting a side surface of the hoistway 1, and the other side of the rail bracket 4 is fastened to the corresponding car rail 3. The rail brackets 4 are vertically spaced apart from each other within the hoistway 1.

[0017] Reference numeral 6 designates counterweight rails which stand upright within the hoistway 1 and are spaced apart from each other in a horizontal direction in the form of two lines. Of the two lines, one line is fastened to the rail brackets 4, and the other line is secured on the fixing members 5 and fastened to counterweight brackets 7 which are vertically spaced apart from each other within the hoistway 1. The counterweight rails 6 guide ascending and descending operation of the counterweight 8 which is interposed between the two lines and moves vertically within the hoistway 1.

[0018] Reference numeral 9 designates a hoisting machine disposed at a position close to the top within the hoistway 1; 10 designates a support member whose both ends are joined to an upper end section of the counterweight rails 6 and which support the hoisting machine 9; and 11 designates a rope anchor arm projectingly provided at a position close to the upper end of the car rails 3.

[0019] Reference numeral 12 designates amain rope. A rope anchor 15 provided at one end of the main rope 12 is joined to the rope anchor arm 11. The other end of the main rope 12 is passed around a car pulley 13 rotatably mounted on a lower section of the car 2. That end of the main rope 12 is then extended upward and passed around a drive sheave of the hoisting machine 9. The rope is then extended downward and passed around a suspension pulley 14 of the counterweight 8. A rope anchor 16 provided at the other end of the rope 12 is joined to a position close to the counterweight rail 6 having the rail brackets 4 provided thereon.

[0020] Reference numeral 17 designates a coupling member. At least one coupling member 17 is disposed between the rail brackets 4 which are vertically spaced apart from each other. The car rail 3 is fastened to one side of the coupling member 17 with a rail clip 18, a bolt 19 inserted into the edge of the coupling member 17, and a nut 20 screw-engaged with an insertion end of the bolt 19. The other end of the coupling member 17 is fastened to the counterweight rail 6 opposing the coupling member 17, with a rail clip 21, a bolt 22 inserted into the edge of the coupling member 17, and a nut 23 screw-engaged with an insertion end of the bolt 22.

[0021] In the elevator system having the foregoing construction, when the hoisting machine 9 is operated, the car 2 and the counterweight 8 ascend and descend in opposite directions via the main rope 12. Self weight of the hoisting machine 9 and load stemming from tension of the main rope 12 are supported by the car rails 3 by way of the rope anchor arm 11 and the counterweight rails 6 by way of the support member 10.

[0022] By means of such a construction, the majority

of the downward load stemming from the tension of the main rope 12 and the like acts on the counterweight rails 6. Therefore, buckling due to the load will develop in the counterweight 8. The coupling member 17 is disposed at least one location between the rail brackets 14 that are spaced apart from each other in the vertical direction, whereby the car rail 3 is coupled to the counterweight rail 6.

[0023] Therefore, displacement-which develops from the downward load due to the tension of the main rope 12 in the counterweight rail 6 in a direction orthogonal to the axis-is transmitted to and supported by the car rail 3 via the coupling member 17. Occurrence of buckling in the counterweight rail 6 is prevented, and hence the strength of the counterweight rail 6 can be made close to the strength required for carrying out the function of guiding the counterweight 8.

[0024] By means of a simple device and construction, the counterweight rails 6 can be reduced in size to rails of standard size without involvement of complicated efforts, thereby curtailing costs for constructing the elevator system.

[0025] Further, the car rail 3 and the counterweight rail 6 are fastened to the coupling member 17 by way of the rail clips 18, 21. Accordingly, the car rail 3 and the counterweight rail 6 can be readily coupled together by means of the coupling member 17 at any appropriate location with respect to the vertical direction. In order to limit, to a predetermined value, the amount of displacement developing in the counterweight rail 6 in the direction orthogonal to the axis, the coupling members 17 can be readily increased to an appropriate number.

[0026] Measures can be readily taken against the amount of displacement developing in the counterweight rail 6 in the direction orthogonal to the axis, the amount differing from one elevator to another elevator. Hence, occurrence of displacement in the counterweight rail 6 in the direction orthogonal to the axis can be prevented through simple operation.

[0027] The rope anchor 16 of the main rope 12 opposing the counterweight 8 is located at a position close to the edge of the support member 10 facing the counterweight rail 6 joined to the coupling member 17. As a result, the majority of the vertical load acting on the rope anchor 16 is supported by the counterweight rail 6 fastened to the coupling member 17. Displacement, which develops from the load of the rope anchor 16 in the counterweight rail 6 close to the coupling member 17 in the direction orthogonal to the axis, is transmitted to and supported by the car rail 3 by way of the coupling member 17.

[0028] Consequently, no buckling occurs in the counterweight rail 6 located close to the coupling member 17. Hence, the strength of the counterweight rail 6 provided close to the coupling member 17 can be made close to the strength required to carry out a function of guiding the counterweight 8. In other words, the counterweight rail 6 can be reduced to a rail of standard size, thereby curtailing costs for constructing the elevator system.

Industrial Applicability

[0029] As has been described, in an elevator system of the invention, when a building where the elevator system is to be installed employs, for a framework formed by assembly of steel products, a flexible structure provided with wall material into which anchor bolts cannot be fastened upright, rail brackets are fastened to the framework material constituting floors of the building. A support member for the hoisting machine disposed at a position close to the top within the hoistway is supported at an upper end section of the counterweight rails which stand upright within the hoistway and guide ascending and descending operation of the counterweight. In connection with such a construction, occurrence of buckling, which would otherwise develop in the counterweight rail in a direction orthogonal to an axis for reasons of compressive load, can be prevented.

[0030] More specifically, the counterweight rail is coupled to the car rail by means of a coupling member provided between rail brackets, the brackets being spaced apart from each other in the vertical direction and fastening the car rail to a fixing member of the hoistway. As a result, the displacement developing in the counterweight rail in the direction orthogonal to the axis is transmitted to and supported by the car rail by way of the coupling member. Consequently, occurrence of buckling in the counterweight rail is prevented, thereby making the strength of the counterweight rail close to that required to carry out a function of gulding the counterweight. The counterweight rail can be reduced in size to a rail of standard size, thereby curtailing costs for constructing the elevator system.

Claims

1. An elevator system, comprising:

   a hoisting machine disposed at a position close to the top within a hoistway;
   a car and a counterweight which are operated by the hoisting machine by way of a main rope to thereby ascend and descend in opposite directions through the hoistway;
   car rails which stand upright within the hoistway and guide ascending and descending operation of the car;
   rail brackets which are spaced apart from each other in a vertical direction, one side of each being secured on a fixing member of the hoistway and the other side of each being fastened to the car rail;
   counterweight rails which stand upright within the hoistway, which are horizontally spaced

apart from each other into two lines, and which support at an upper end thereof a support member of the hoisting machine, wherein one of the two lines is fastened to the rail brackets, and the counterweight rails guide ascending and descending operation of a counterweight interposed between the two lines; and

a coupling member whose one side is fastened to the car rail, whose other side is fastened to the opposing counterweight rail, and which is provided between the rail brackets which are spaced apart from each other in the vertical direction.

2. The elevator system according to claim 1, wherein the car rail and the counterweight rail are fastened to the coupling member by way of rail clips.

3. The elevator system according to claim 1, wherein a rope anchor, which couples an end section of a main rope opposing the counterweight to the support member of the hoisting machine, is provided at a position close to the counterweight rail fastened to the coupling member.

FIG. 1

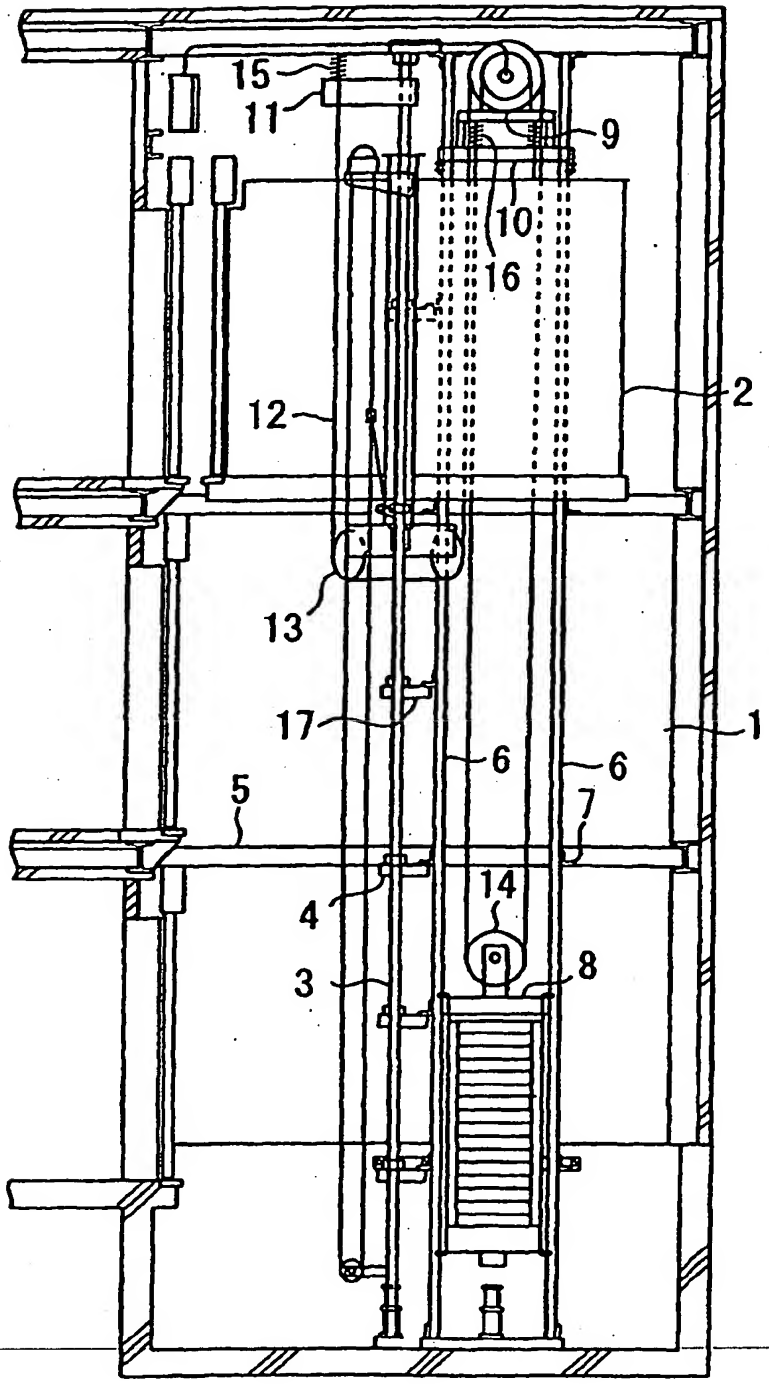


FIG. 2

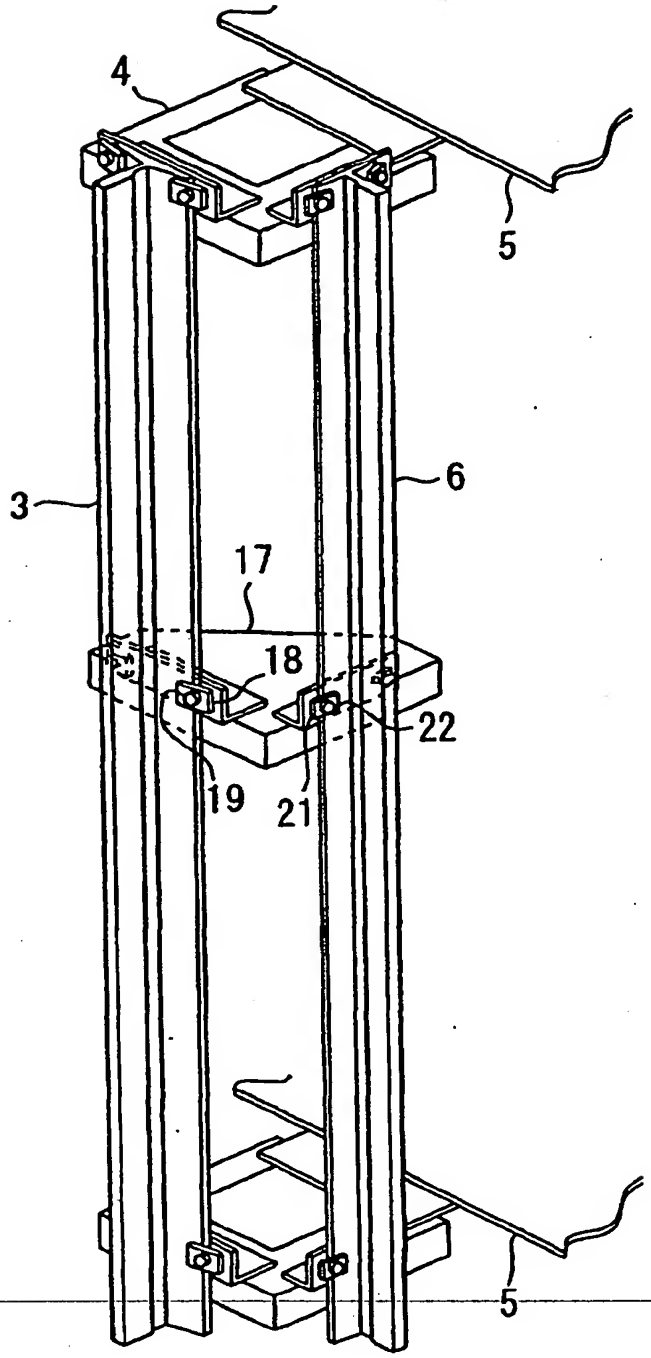


FIG. 3

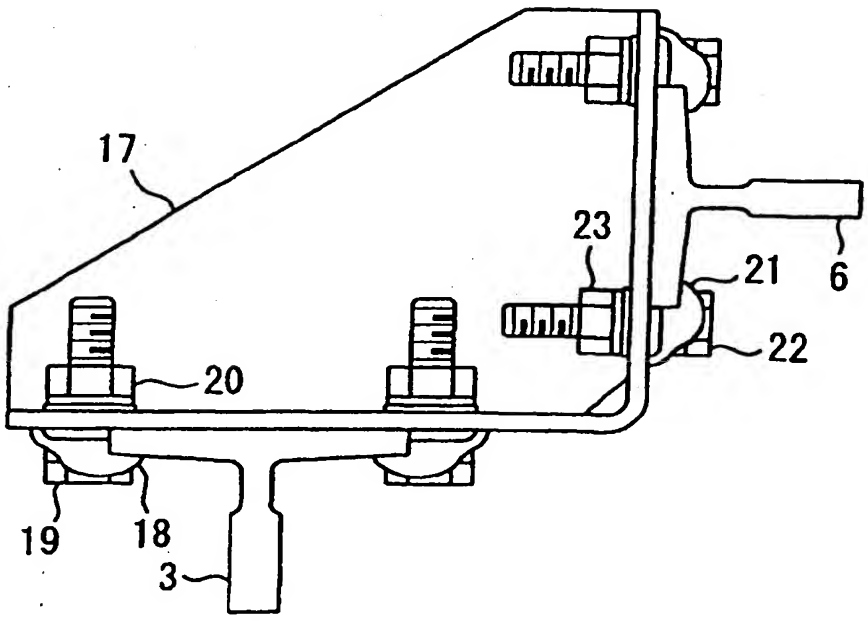


FIG. 4

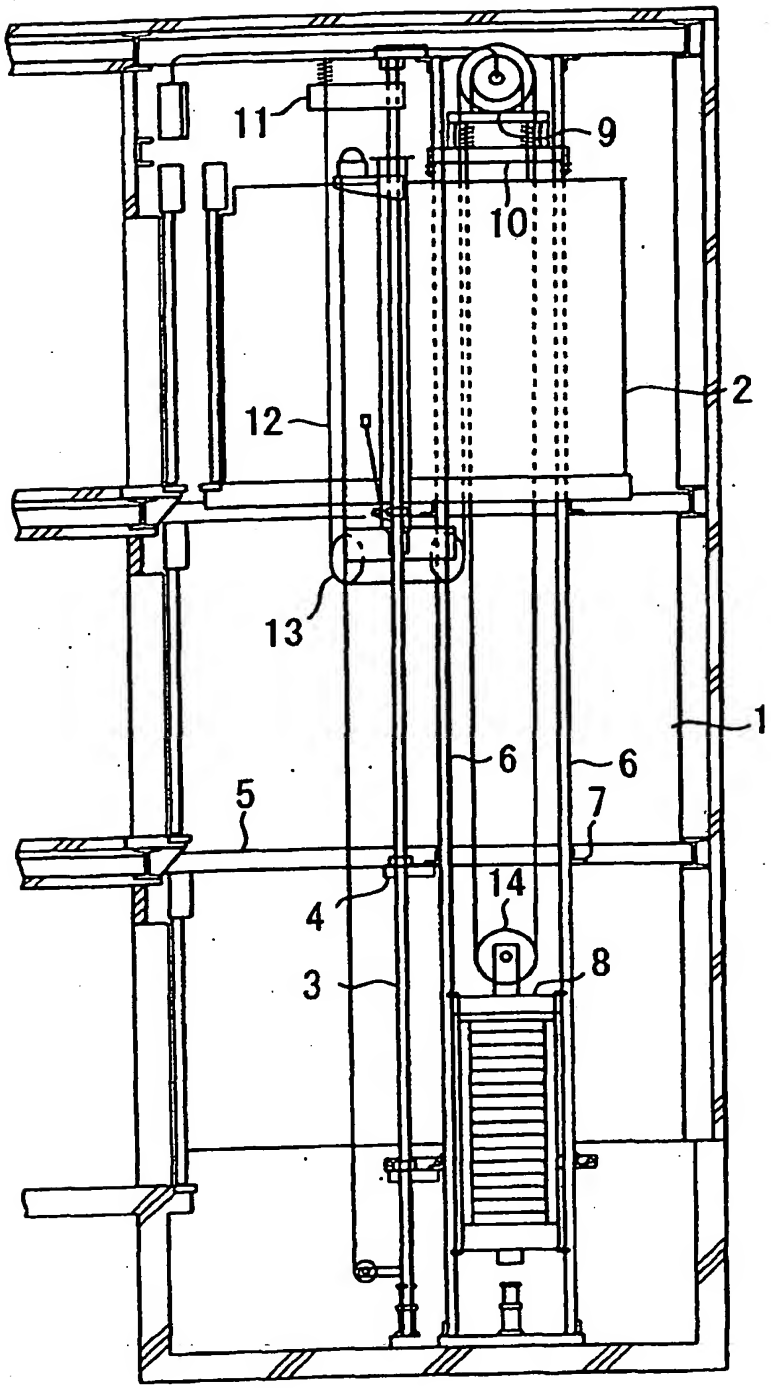
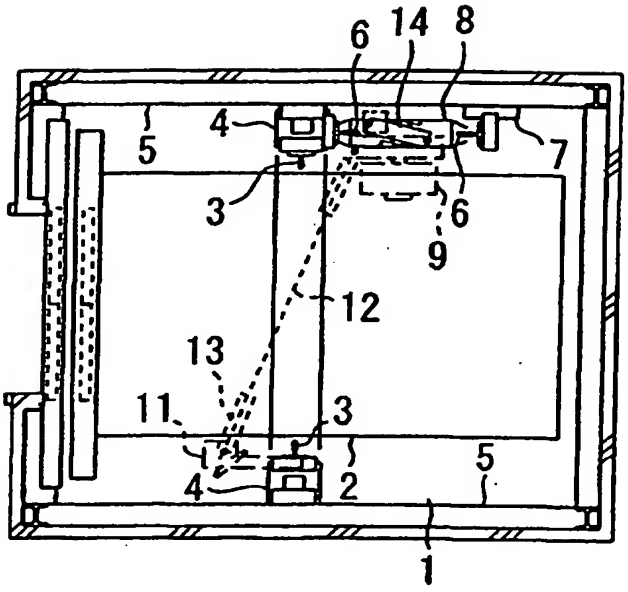


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP01/10299

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B66B7/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] B66B7/00-B66B11/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2002
Kokai Jitsuyo Shinan Koho	1971-2002	Toroku Jitsuyo Shinan Koho	1994-2002

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 2000-44146 A (Hitachi, Ltd.), 15 February, 2000 (15.02.00), (Family: none)	1-2 3
Y A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 67035/1985 (Laid-open No. 183379/1986) (Mitsubishi Electric Corp.), 15 November, 1986 (15.11.86), (Family: none)	1-2 3
A	JP 2001-171953 A (Fujitec Co., Ltd.), 26 June, 2001 (26.06.01), (Family: none)	1-3

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search 15 August, 2002 (15.08.02)	Date of mailing of the international search report 10 September, 2002 (10.09.02)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP01/10229

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2001-48441 A (Hitachi Building Systems Co., Ltd.), 20 February, 2001 (20.02.01), (Family: none)	1-3
A	JP 2000-177949 A (Hitachi Building Systems Co., Ltd.), 27 June, 2000 (27.06.00), (Family: none)	1-3
A	JP 1-150687 A (Toshiba Corp.), 13 June, 1989 (13.06.89), (Family: none)	1-3

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